Appendix A - The Impact of Changes in Population Health and Mortality on Future Prevalence of Alzheimers Disease and Other Dementias in the United States

1 Summary of the Future Elderly Model

The Future Elderly Model (FEM) is a microsimulation model originally developed out of an effort to examine health and health care costs among the elderly Medicare population (age 65+). A description of the previous incarnation of the model can be found in Goldman et al. (2004). The original work was founded by the Centers for Medicare and Medicaid Services and carried out by a team of researchers composed of Dana P. Goldman, Paul G. Shekelle, Jayanta Bhattacharya, Michael Hurd, Geoffrey F. Joyce, Darius N. Lakdawalla, Dawn H. Matsui, Sydne J. Newberry, Constantijn W. A. Panis and Baoping Shang.

Since then various extensions have been implemented to the original model. The most recent version now projects health outcomes for all Americans aged 51 and older and uses the Health and Retirement Study (HRS) as a host dataset rather than the Medicare Current Beneficiary Survey (MCBS). The work has also been extended to include economic outcomes such as earnings, labor force participation and pensions. This work was funded by the National Institute on Aging through its support of the RAND Roybal Center for Health Policy Simulation (P30AG024968), the Department of Labor through contract J-9-P-2-0033, the National Institutes of Aging through the R01 grant "Integrated Retirement Modeling" (R01AG030824) and the MacArthur Foundation Research Network on an Aging Society.

More recently, a version of the FEM has been extended to investigate Alzheimer's disease and related dementias. A full technical appendix for that project is available here: `https://healthpolicy.box.com/v/AD-FEM-Appendix`. Transition models for that project are available here: `https://healthpolicy.box.com/v/AD-FEM-Tables`.

2 Extensions for this analysis

2.1 ADRD Measures

A key extension of FEM for this project was the evaluation of measures of dementia in the HRS. Cognitive functioning of HRS respondents is assessed at each wave using an adapted version of the Telephone Interview for Cognitive Status (TICS) or is provided by a proxy respondent, typically a spouse or other family member (see (Ofstedal et al., 2005)). HRS imputed these measures when missing because they are not randomly missing, but tend to be missing for the more cognitively impaired. The method is described in Fisher et al. (Fisher et al., 2013). We assign cognitive

state based on scores from the assessments. We sum score of 3 cognitive assessments (range 0-27): immediate and delayed word recall (0-20); counting down from 100 by 7s test score (0-5); and counting back from 20 (0-20). For proxy interviews, the cognition scale (range 0-11) sums the following: number of instrumental activities of daily living (IADLs) (0-5); interviewer impairment rating (0 = no cognitive limitations, 1 = some limitations, 2 = cognitive limitations); and proxy informants rating of the respondents memory (from 0 [excellent] to 4 [poor]). Cognition scores range as follows: 0-6 = demented, 7-11 = mild impairment, no dementia, and 12-27 = normal. Proxy scores are as follows: 0-2 = normal, 3-5 = mild impairment, no dementia, and 6-11 = demented. Both proxy and nonproxy scores are combined into one variable. We find that individuals may transition into and out of dementia. Thus, in order to be categorized as having dementia, we require one wave with dementia and evidence of continued cognitive impairment (either CIND or dementia) in the subsequent wave. If the respondent with one wave of dementia dies before the subsequent wave, we assume dementia.

2.2 ADRD Transition Model

We model the transition to dementia, conditional on survival. Using our persistent measure of dementia, we treat dementia as an absorbing state. We estimate a Markov model using a probit model and covariates include age, age-squared, sex, education (less than high school, high school, some college or higher), race (non-Hispanic white, Hispanic, black), instrumental activity of daily living (difficulty with any), BMI (underweight, normal, obese), smoking status, and existence of disease conditions correlated with dementia (diabetes, heart disease, hypertension, stroke) and other health conditions (lung disease, cancer). Since the model of dementia requires a follow-up wave for for confirmation, this restricts the estimation from using the most recent wave of the HRS.

The lag of dementia is included as a predictor in several other transition models: mortality, ADL status, IADL status, nursing home status, and models associated with receiving informal care. These transition models are presented in the accompanying Excel file.

References

Fisher, G. G., Hassan, H., Rodgers, W., and Weir, D. (2013). Health and retirement study imputation of cognitive functioning measures: 1992–2010 (final release version) data description. *Ann Arbor: University of Michigan, Survey Research Center*.

Goldman, D. P., Shekelle, P. G., Bhattacharya, J., Hurd, M., and Joyce, G. F. (2004). Health status and medical treatment of the future elderly. Technical report, DTIC Document.

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